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CLAIMS

## 1. Curable powder coating obtainable by

## (i) mixing

- 5 (a) a polymeric binder, an oxazine resin, a cyanate ester or a maleimide,
- (b) a hardener or initiator,
- (c) a coating additive,
- (d) optionally a filler,
- 10 (e) optionally a compatibilizing polymer
- and optionally further components
- (ii) melt extruding the mixture obtained in step (i) and
- (iii) milling and sieving the extruded mixture.

- 15 2. Powder coating according to claim 1, characterized in that it has a glass transition temperature in the uncured state of at least 20°C, preferably at least 25°C and more preferably at least 30°C and that it has a glass transition temperature in the cured state of at least 150°C, preferably at least 160°C and more preferably at least 170°C.

- 20 3. Powder coating according to claim 1, characterized in that the polymeric binder is a solid epoxy resin.

4. Powder coating according to claim 1 or 3, characterized in that the component (a) comprises a mixture of epoxy resins with a glass transition temperature of at least 20°C .

5. Powder coating according to claim 1, 3 or 4, characterized in that the epoxy resin is selected from the group consisting of standard solid epoxy resins based on bisphenol A and bisphenol A diglycidyl ether.
6. Powder coating according to claim 5, characterized in that the epoxy equivalent weight of the epoxy resin is  $> 300$  g/equivalent.
7. Powder coating according to claim 1, characterized in that the epoxy resin contains a multifunctional epoxy resin or a mixture of multifunctional epoxy resins.
8. Powder coating according to claim 7, characterized in that the multifunctional epoxy resin is selected from the group consisting of cresol-novolak epoxy resins, phenol-novolak epoxy resins and naphthol-containing multifunctional epoxy resins.
9. Powder coating according to claim 1, characterized in that the cyanate ester is selected from the group consisting of bifunctional and multifunctional cyanate esters.
10. Powder coating according to claim 1, characterized in that the maleimide is selected from the group consisting of bifunctional and multifunctional maleimides, preferably on the basis of aromatic diamines and in that the oxazine resin is selected from the group consisting of bifunctional and multifunctional oxazine resins.
11. Powder coating according to claim 1, characterized in that the hardener is selected from the group consisting of phenolic hardeners, bisphenol A, dicyandiamide or modified dicyandiamide, acid anhydrides, aromatic and aliphatic amines or ring-substituted diamines.
12. Powder coating according to claim 11, characterized in that the hardener is dicyandiamide or a modified dicyanamide.

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13. Powder coating according to claim 1, 11 or 12, characterized in that it contains the hardener or initiator in an amount of 0.1 to 10 wt.-%, preferably 0.5 to 5 wt.-%.
14. Powder coating according to claim 1, characterized in that it contains the  
5 coating additives in an amount of 0.1 to 10 wt.-%.
15. Powder coating according to claim 1, characterized in that it contains the filler in an amount of 5 to 300 wt.-%, preferably 10 to 200 wt.-%, more preferably 10 to 100 wt.-%, based on components (a), (b) and (c).
16. Powder coating according to claim 1 or 15, characterized in that the filler is  
10 an inorganic filler.
17. Powder coating according to claim 16, characterized in that the filler is fused silica or kaoline.
18. Powder coating according to claim 16 or 17, characterized in that the filler  
15 has an average particle size of less than 30  $\mu\text{m}$ , preferably less than 20  $\mu\text{m}$  and more preferably less than 10  $\mu\text{m}$ .
19. Powder coating according to claim 1 or 15, characterized in that the filler is an organic filler which does not melt upon processing of the powder coating.
20. Powder coating according to claim 1 or 15, characterized in that the filler is  
20 an organic filler which melts upon processing of the powder coating and shows phase separation upon cooling.
21. Powder coating according to claim 1 or 15, characterized in that the filler is polyphenyl ether or a fluorinated thermoplastic, in particular, poly(tetrafluoroethylene) (PTFE), ethylene/tetrafluoroethylene copolymer (ETFE) or tetrafluoroethylene/hexafluoropropylene copolymer.
22. Powder coating according to claim 1, characterized in that its coefficient of  
25 thermal expansion in the hardened state is  $< 70 \text{ ppm}/^{\circ}\text{C}$ , preferably  $< 60 \text{ ppm}/^{\circ}\text{C}$  in the x-, y- and z-direction.

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23. Powder coating according to claim 1, characterized in that its dielectric constant in the hardened state is  $< 3.8$ , preferably  $< 3.6$ .
24. Powder coating according to claim 1, characterized in that it is stable in storage, wherein its exotherm does not decrease by more than 10% upon storage for three months at 25°C.
25. Powder coating according to claim 1, characterized in that it comprises as component (a) about 50-90 wt.-% of epoxide and about 5-20 wt.-% of cyanate ester, as component (b) about 0.5-5 wt.-% dicyandiamide and about 0.1-2 wt.-% of 2-phenylimidazole.
26. Process for the preparation of the curable powder coating according to claim 1, characterized by the following steps:
- (i) mixing of components (a), (b), (c) and optionally (d) and (e),
  - (ii) melt extrusion of the mixture obtained in step (i) and
  - (iii) milling and sieving of the extruded mixture.
27. Process according to claim 26, characterized in that two or more of the components (a), (b), (c), (d) and (e) are used as a master batch in step (i).
28. Process according to claim 26 or 27, characterized in that step (ii) is carried out such that the conversion of the reactive component is less than 20%, preferably less than 10%.
29. Process for the preparation of coating layers on substrates comprising the following steps:
- (i) wet milling of the powder coating according to one of claims 1 to 25, optionally with further additives to prepare a dispersion,
  - (ii) applying the dispersion to the substrate and
  - (iii) heat treating the coated substrate.

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30. Process according to claim 29, characterized in that the heat treatment in step (iii) is carried out such that, after applying the dispersion to the substrate, the film is first dried and melted and subsequently cured.
- 5 31. Process according to claim 29, characterized in that the heat treatment of the coated substrate in step (iii) is carried out such that, after applying the dispersion to the substrate, a single step of drying, melting and curing the powder coating is carried out.
32. Process for preparing a multilayer structure comprising the following steps:
- 10 (i) wet milling of the powder coating according to one of claims 1 to 25, optionally with further additives to prepare a dispersion,
- (ii) applying the dispersion to a structured substrate,
- (iii) heat treating the coated substrate,
- (iv) drilling and metallizing,
- (v) optionally repeating steps (ii) and (iv).
- 15 33. Process according to one of claims 29 to 32, characterized in that the substrate is a copper sheet, a polymeric support sheet, a structured printed circuit board or a core layer thereof.
34. Process according to claim 33, characterized in that the support sheet is combined with woven or non-woven fabric of glass fibre or aramide fibre.
- 20 35. Process according to claim 29 or 32, characterized in that antifoaming agents, wetting agents, biocides, rheologic additives or flow-control agents are used as additives.
36. Process according to claim 29 or 32, characterized in that the heat treatment or the curing is effected by
- 25 (a) melting in an oven with or without convection,

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- (b) infrared radiation,
- (c) near infrared radiation (NIR),
- (d) induction or
- (e) excitation by microwaves.

5 37. Process for preparing coating layers on substrates comprising the following steps:

- (i) applying the powder coating according to one of claims 1 to 25 to a substrate,
- (ii) melting the powder coating and
- 10 (iii) curing the powder coating.

38. Process for preparing a multilayer structure comprising the following steps:

- (i) applying the powder coating according to one of claims 1 to 25 to the substrate,
- (ii) melting the powder coating followed by cooling,
- 15 (iii) laminating the coated substrate to a printed circuit board which may already comprise more than one layer,
- (iv) curing,
- (v) drilling and through-connecting the individual layers and substrates to prepare a multilayer structure,
- 20 (vi) optionally repeating steps (i) to (v).

39. Process according to claim 37 or 38, characterized in that the substrate is a copper sheet or a polymeric support sheet.

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40. Process according to claim 39, characterized in that the support sheets are combined with woven or non-woven fabric of glass fibre or aramide fibre.

41. Process for the preparation of a multilayer structure comprising the following steps:

- 5 (i) applying the powder coating according to one of claims 1 to 25 to a structured substrate,
- (ii) melting and curing the powder coating layer followed by cooling,
- (iii) drilling,
- (iv) metallizing,
- 10 (v) optionally repeating steps (i) to (iv).

42. Process according to one of claims 37 to 41, characterized in that the application of the powder coating is effected by spraying, electromagnetic brush coating, powder cloud coating or roller coating.

15 43. Process according to claim 42, characterized in that the spraying is effected by coronar charging or triboelectric charging.

44. Process according to one of claims 37 to 41, characterized in that the melting is effected by

- (a) melting in an oven with or without convection,
- (b) infrared radiation,
- 20 (c) near infrared radiation (NIR),
- (d) induction or
- (e) excitation by microwaves.